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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/833,791	04/13/2001	Walter K. Feldman	FE-493-US	1926

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EXAMINER	
HOGAN, MARY C	

ART UNIT	PAPER NUMBER
2123	

DATE MAILED: 09/13/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)
	09/833,791	FELDMAN ET AL.
	Examiner	Art Unit
	Mary C Hogan	2123

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *14 June 2002*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-13* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-13* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *13 April 2001* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

1. This application has been examined.

2. **Claims 1-13** have been examined and rejected.

Information Disclosure Statement

3. The reference cited, (IPER for PCT/US/01/0863) filed June 14, 2002, has been considered, but will not be listed on any patent resulting from this application because it was not provided on a separate list in compliance with 37 CFR 1.98(a)(1). In order to have the references printed on such resulting patent, a separate listing, preferably on a PTO-1449 form, must be filed within the set period for reply to this Office action.

Specification

4. The disclosure is objected to because of the following informalities. Appropriate correction is required.

5. **Page 28, line 26** is grammatically incorrect and "applications" is misspelled.

Claim Objections

6. **Claims 2 and 8** are objected to because of the following informalities. Appropriate correction is required.

7. **Claims 2 and 8:** "at at" in line 2 of the claim.

Claim Interpretation

8. **Claims 1 and 7** refer to "figure of merit", however, it is unclear from the claims what a "figure of merit" refers to. The specification (page 24) describes that the figure of merit is used to assess the "goodness" of a candidate model.

9. **Claims 1,2,7 and 8** refer to gravity gradients including Uxx - Uyy and 2Uxy components. It was concluded from the specification these gravity gradients are components in a nine-term gravity gradient tensor that is shown on **page 10**.

10. **Claims 4 and 10** refer to a two-dimensional model, however, this model has a depth variable as stated in the claims and shown in **Figure 5**. It was concluded that the addition of this "z" or depth parameter to the model adds a third dimension to the model, and therefore, the claim is directed to a three-dimensional model.

35 USC § 101

11. 35 U.S.C. 101 reads as follows:

Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

12. **Claims 1-6** are rejected under 35 U.S.C. 101 because the claimed invention is not supported by an asserted or well established utility and is not tangible.

13. An invention, which is eligible for patenting under 35 U.S.C.101, is in the useful arts when it is a machine, manufacture, process or composition of matter, which produces a concrete, tangible, and useful result. The fundamental test for patent eligibility is thus to determine whether the claimed invention produces a ***useful, concrete and tangible result.*** The test for practical application as applied by the examiner involves the determination of the following factors:

(1) Useful- The Supreme Court in *Diamond v. Diehr* requires that the examiner look at the claimed invention as a whole and compare any asserted utility with the claimed invention to determine whether the asserted utility is accomplished. Applying utility case law the examiner will note that:

(a) the utility need not be expressly recited in the claims, rather it may be inferred.

(b) if the utility is not asserted in the written description, then it must be well established.

(2) Tangible - Applying *In re Warmerdam*, 33 F.3d 1354, 31 USPQ2d 1754 (Fed. Cir. 1994), the examiner will determine whether there is simply a mathematical construct claimed, such as a disembodied data structure and method of making it. If so, the claim involves no more than a manipulation of an abstract idea and therefore, is nonstatutory under 35 U.S.C. 101. In *Warmerdam* the abstract idea of a data structure became capable of producing a useful result when it was fixed in a tangible medium which enabled its functionality to be realized.

(3) Concrete- Another consideration is whether the invention produces a concrete result. Usually, this question arises when a result cannot be assured. An appropriate rejection under 35 U.S.C. 101 should be accompanied by a lack of enablement rejection, because the invention cannot operate as intended without undue experimentation.

14. Furthermore, although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

15. **Claims 1-6** recite "obtaining" a set of data. The language of the claim raises a question as to whether the claim is directed merely to an abstract idea that is not tied to a technological art, environment or machine which would result in a practical application producing a concrete, useful, and tangible result to form the basis of statutory subject matter under 35 U.S.C. 101. It is noted that if the term "obtaining" read "measuring" as in Claim 7, the claim would reside in a technological art.

Claim Rejections - 35 USC § 103

16. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

17. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

18. **Claims 1-13** are rejected under 35 U.S.C. 103(a) as being unpatentable over Nagihara et al (Nagihara et al, "Three-dimensional Gravity Inversion Based on the Simulated Annealing Algorithm for Constraining Diapiric Roots of Salt Canopies", University of Houston, 1999), herein referred to as **Nagihara**, in view of Lumley, David E. (Lumley, David E., "4-D Seismic Monitoring of Reservoir Fluid-Flow Processes", SPIE Conference, 1994), herein referred to as **Lumley**, in further view of Integrated Geophysics Corporation (Integrated Geophysics

Corporation, "Gravity Gadiometry in Natural Resource Exploration", Footnotes on Interpretation, Vol. 4, No.1, June 1997), herein referred to as **IGC**.

19. As to **Claims 1 and 7, Nagihara** teaches: a method of determining time-dependent changes in subsurface density of a natural resource reservoir, comprising the steps of:

creating a model of the change in density of the reservoir having a plurality of volume elements therein, including constraints on the model **(page 1, column 2, Methodology, paragraphs 1 and 3)** wherein the gravity anomaly observation can be inverted for a density structure model and the inverting involves dividing the source volume into a number of blocks and further constrains the density of each block;

establishing a set of quantized mathematically related parameters defining the density model **(page 2, column 1, paragraph 2)** wherein inversion obtains a set of model parameter values, and computing a corresponding figure of merit therefor **(page 2, column 1, equation 1 and description)** wherein the figure of merit is ΔE;

perturbing at least one parameter of the model and recalculating the figure of merit for the perturbed model **(page 2, column 1, paragraph 2)** wherein the model perturbation-acceptance routine is repeated until E(m) no longer decreases after many iterations;

evaluating the figure of merit for the perturbed model relative to that of the immediately preceding model and accepting the perturbed model if more optimal relative to the immediately preceding model and accepting the perturbed model if less optimal in accordance with a probability function that varies in accordance with a control parameter **(page 2, column 1, paragraph 2)**;

and repeating the perturbing and evaluation steps while the control parameter decreases the probability function with successive repetitions **(page 2, column 1, paragraph 2)**.

20. **Nagihara** teaches obtaining gravity data for a sub-surface natural resource deposit characterized by density **(page 1, column 2, Methodology, paragraph 1, "gravity anomaly observation")**.

21. **Nagihara** does not expressly teach obtaining a set of time-lapse gravity gradient data.

22. **Lumley** teaches the method of 4-D monitoring in which several repeat 3-D seismic surveys are acquired in time-lapse mode which offers a method of better characterization of reservoir complexity by monitoring the flow of fluids in time in a producing reservoir **(page 1, Introduction, paragraph 1)**.

23. It would have been obvious to one of ordinary skill in the art at the time the invention was made to obtain gravity data as taught in **Nagihara** using a time-lapse process as taught in **Lumley** since obtaining gravity data in a time-lapse mode offers a method of better characterization of reservoir complexity by monitoring the flow of fluids in time in a producing reservoir as taught by **Lumley (page 1, Introduction, paragraph 1)**.

24. **Nagihara** teaches obtaining gravity data for a sub-surface natural resource deposit characterized by density **(page 1, column 2, Methodology, paragraph 1, "gravity anomaly observation")** and **Lumley** teaches the method of 4-D monitoring in which several repeat 3-D seismic surveys are acquired in time-lapse mode and the gravity potential field, U **(page 8, equation 28)**.

25. **Nagihara and Lumley** do not expressly teach computing at least gravity gradients for the quantized model.

26. **IGC** teaches gravity gradient data as the gradient terms comprising the gravity field's gradient tensor. This tensor, including the gradient terms, completely describes the anomalous gravity field **(Page 2, Gravity Gradiometry vs. Conventional Gravimetry, paragraph 1)**.

27. It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the gravity potential field, U, as taught in **Lumley** to compute the gravity gradient data as taught in **IGC** since gravity gradient data are the gradient terms that comprise a gravity field's gradient tensor and the tensor, including the gradient terms, completely describes the anomalous gravity field **(Page 2, Gravity Gradiometry vs. Conventional Gravimetry, paragraph 1).**

28. As to **Claims 2 and 8**, **IGC** teaches the gravity gradient data includes at least the Uxx - Uyy and 2Uxy components **(Page 2, Gravity Gradiometry vs. Conventional Gravimetry, paragraph 1),** wherein it is taught that the gravity field's nine-term gradient tensor completely describes the anomalous gravity field. From this explanation, it is determined that these nine terms include the Uxx - Uyy and 2Uxy components. Further, the Uxx and Uyy components of the tensor are shown **(Figures, page 3)**.

29. As to **Claims 3 and 9**, **Lumley** teaches: the time-lapse data sets include at least the positional coordinates for a plurality of measurement sites **(page 10, paragraph 2)** where 312 individual blocks are in a grid that would specify the coordinates of where the measurements were taken from, time-lapse gravity gradient data at each site and the time between measurements **(page 10, paragraph 1)** where reservoir geology and core data measurements were taken and the data was taken at 56 and 113 days.

30. As to **Claims 4,5,10 and 11, Nagihara** teaches: a three-dimensional model of rectangular, volume elements or "cubes" over depth **(Figure 1 and description)**.

31. As to **Claims 6 and 13, Nagihara** teaches: said constraints are implemented by a penalty function **(page 2, column 1, paragraph 2)**, wherein T, as the control parameter, is a penalty function since it will effect the probability by which a model is accepted based on its value.

32. As to **Claim 12, Lumley** teaches the set of quantized mathematically related parameters are functionally related to the changes in saturation of the oil and the driveout fluid in each volume element **(page 10, paragraphs 1 and 2)** wherein the volume elements in the grid are given oil saturation and gas saturation, gas being the driveout fluid in this experiment.

Conclusion

33. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Mary C Hogan whose telephone number is 703-305-7838 or 571-272-3712 starting mid-October 2004. The examiner can normally be reached on 7:30AM-5PM Monday-Friday. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kevin Teska can be reached on 703-305-9704. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Mary C Hogan
Examiner
Art Unit 2123

JEAN R. HOMERE
PRIMARY EXAMINER